

Identification	Subject (Code, title, credits)	ETR401, Wireless communication technology, 6 ECTS
	Department	Physics and Electronics
	Program	Graduate
	Term	Spring 2026
	Instructor	MSc, Yusif Shamayev
	E-mail:	yusifshamayev@gmail.com
	Phone:	
	Classroom/hours	11 Mehseti str. (Neftchilar campus)
	Consultations	Saturday 13:00 – 14:00
Prerequisites	-	
Language	English	
Compulsory/ Elective	Elective	
Required textbooks and course materials	Textbooks: <ol style="list-style-type: none"> 1. Wireless Communication Networks and Systems; Cory Beard, William Stallings, 2015 2. Wireless Communications Systems; Randy L. Haupt, 2020 3. Wireless Communications; Andrea Goldsmith, 2005 4. Wireless Communication Systems: From Fundamentals to 6G — Ke-Lin Du & M. N. S. Swamy, 2021 5. Introduction to Wireless Communications and Networks: A Practical Perspective — Krishnamurthy Raghunandan, 2021 6. Enabling Technologies for Next Generation Wireless Communications — Usman Wajid, et al., 2021 	
Course description	<p>The course addresses the fundamentals of wireless communications and provides an overview of existing and emerging wireless communications networks. It covers radio propagation and fading models, fundamentals of cellular communications, multiple access technologies, and various wireless networks, including past and future generation networks. Simulation of wireless systems under different channel environments will be integral part of this course.</p>	
Course objectives	<p>To provide students with a comprehensive understanding of the principles and fundamentals of wireless communication systems.</p> <p>To introduce different types of wireless communication technologies, including cellular, satellite, Wi-Fi, and emerging 5G/6G networks.</p> <p>To develop knowledge of radio wave propagation, modulation techniques, and signal transmission in wireless environments.</p> <p>To familiarize students with the design and analysis of wireless communication systems, including antennas, transmitters, and receivers.</p> <p>To equip students with the skills to evaluate and optimize wireless network performance in practical applications.</p>	

Learning outcomes	<p>Upon successful completion of this course, students will be able to:</p> <ul style="list-style-type: none"> • Demonstrate a thorough understanding of the principles and concepts underlying wireless communication systems. • Analyze and predict radio wave propagation, path loss, fading, and interference effects in various wireless environments. • Apply appropriate modulation, multiplexing, and coding techniques to design efficient wireless communication links. • Evaluate the performance of antennas, transmitters, receivers, and overall wireless systems in practical scenarios. • Critically assess and optimize wireless network performance, including coverage, capacity, and reliability. • Explain and differentiate modern wireless communication standards and technologies, including LTE, 5G, and emerging 6G systems. • Solve real-world problems in wireless system design, implementation, and network planning using analytical and simulation tools. 		
Teaching methods	Case analysis		x
	Group discussion		x
	Lecture		x
	Simulation		x
Evaluation Criteria	Methods	Date/deadlines	Percentage (%)
	Midterm Exam		30
	Attendance	At each lesson	5
	Quizzes	4 quizzes during the semester	20
	Activity	During the semester	5
	Final Exam		40
	Total		100

Class Policy	<ul style="list-style-type: none"> ▪ Preparation for class The structure of this course makes your individual study and preparation outside the class extremely important. The lecture material will focus on the major points introduced in the text. Reading the assigned chapters and having some familiarity with them before class will greatly assist your understanding of the lecture. After the lecture, you should study your notes and work on relevant problems and cases from the end of the chapter and sample exam questions. ▪ Withdrawal (pass/fail) This course strictly follows the grading policy of the School of Science and Engineering. Thus, a student is expected to achieve a mark of at least 60% to pass. In case of failure, he/she will be required to repeat the course the following term or year. ▪ Cheating/plagiarism Cheating or other plagiarism during the Quizzes, Midterm, and Final Examinations will lead to paper cancellation. In this case, the student will automatically get zero (0) without consideration. ▪ Professional behavior guidelines The students shall behave in a way to create a favorable academic and professional environment during class hours. Unauthorized discussions and unethical behavior are strictly prohibited. ▪ Attendance Students who attend the whole classes will get 5 marks. For three absents student loses 1 mark. ▪ Quizzes There will be 4 quizzes in the semester. The quizzes will be announced in the classroom two weeks before and will relate to homework. ▪ Activity Students who will be active during discussion of past lessons will be awarded with one activity mark.
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Weeks	Topics	Reference to textbooks
1.	Introduction to Wireless Communications, The Global Cellular Network, The Mobile Device Revolution, Future Trends, The Trouble with Wireless. Satellite communication.	[1]p01 [2]p39 [3]p30
	Conduction of oral and written survey. Problem solving	[4]p47
2.	Transmission Fundamentals, Signals for Conveying Information, Analog and Digital	[1]p09 [2]p47
	Data Transmission, Channel Capacity Transmission	
3.	Conduction of oral and written survey. Problem solving	
	Communication Networks, LANs, MANs, and WANs, Switching Techniques, Circuit Switching, Packet Switching, Quality of Service	[1]p40
4.	Conduction of oral and written survey. Problem solving	
	Protocols and the TCP/IP Suite, The Need for a Protocol Architecture, The TCP/IP Protocol Architecture, The OSI Model, Internetworking	[1]p62 [2]p428 [3]p564
5.	Conduction of oral and written survey. Problem solving	
	Overview of Wireless Communication, Spectrum Considerations, Line-Of-Sight Transmission, Fading in the Mobile Environment, Channel Correction Mechanisms, Digital Signal Encoding Techniques, Coding and Error Control, Orthogonal	[1]p93 [3]p374

	Frequency Division Multiplexing (OFDM), Spread Spectrum	
	Quiz 1 - Lecture 1 – Lecture 4	
6.	The Wireless Channel, Antennas, Spectrum Considerations, Line-Of-Sight Transmission, Fading in the Mobile Environment	[1]p156 [2]p139
	Conduction of oral and written survey. Problem solving	
7.	Signal Encoding Techniques, Signal Encoding Criteria, Digital Data, Analog Signals, Analog Data, Analog Signals, Analog Data, Digital Signals,	[1] 201
	Quiz 2 - Lecture 5 – Lecture 6	
8.	Mid term exam	
9.	Orthogonal Frequency Division Multiplexing, Orthogonal Frequency Division Multiplexing. Orthogonal Frequency Division Multiple Access (OFDMA), Single- Carrier FDMA , Spread Spectrum, The Concept of Spread Spectrum, Frequency Hopping Spread Spectrum. Direct Sequence Spread Spectrum, Code Division Multiple Access	[1]p252 [1]p432 [1]p236 [3] p403
	Conduction of oral and written survey. Problem solving	
10.	Coding and Error Control, Error Detection, Block Error, Correction Codes, Convolutional Codes, Automatic Repeat Request	[1] p273
	Conduction of oral and written survey. Problem solving	
11.	Wireless LAN Technology, IEEE 802 Architecture, IEEE 802.11 Architecture and Services, IEEE 802.11 Medium Access Control, IEEE 802.11 Physical Layer, Gigabit Wi-Fi, Other IEEE 802.11 Standards, IEEE 802.11I Wireless LAN Security 3	[1] p321 [3] p 564
	Quiz 3 - Lecture 7 – Lecture 10	
12.	Bluetooth and IEEE 802.15, The Internet of Things, Bluetooth Motivation and Overview, Bluetooth Specifications, Bluetooth High Speed and Bluetooth Smart, IEEE 802.15, ZigBee	[1] p376
	Conduction of oral and written survey. Problem solving	
13.	Cellular Wireless Networks, Principles of Cellular Networks, First-Generation Analog, Second-Generation TDMA, Second-Generation, CDMA, Third-Generation Systems	[1] p 409
	Conduction of oral and written survey. Problem solving	
14.	Fourth Generation Systems and LTE-Advanced, Purpose, Motivation, and Approach to 4G, LTE Architecture, Evolved Packet Core, LTE Resource Management, LTE Channel Structure and Protocols, LTE Radio Access Network	[1] p451
	Quiz 4 - Lecture 11 – Lecture 13	
15.	Long Range Communications, Satellite Parameters and Configurations Satellite Capacity Allocation Satellite Applications, Fixed Broadband Wireless Access, WiMAX/IEEE, Smart Grid	[1] p525
	Solving problems and ambiguities of students about the course	

This syllabus is a guide for the course and any modifications to it will be announced in advance.

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